

TWENTY-THIRD MONTHLY REPORT  
OF THE  
OREGON—  
STATE WEATHER BUREAU

IN COÖPERATION WITH U. S. SIGNAL SERVICE.

Report for the Month of February, 1891.

PREPARED UNDER THE DIRECTION OF

H. E. HAYES, Master of State Grange, Director,

—BY—

B. S. PAGUE,

U. S. SIGNAL SERVICE, ASSISTANT DIRECTOR.

CENTRAL OFFICE, PORTLAND, OREGON.

PUBLISHED BY AUTHORITY.



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1891.

## TABLE OF CONTENTS, FEBRUARY, 1891.

	PAGE.
Bulletin for February, 1891-----	3
Miscellaneous Meteorological Data, Table No. 1-----	17
Daily Precipitation, Table No. 2-----	18
Correspondents' Remarks-----	7-11
Velocity and Direction of Wind at Portland-----	14
Average Data-----	12-13
Soil Temperature at Pendleton-----	15
Air and Soil Temperature at Corvallis-----	16
National Weather Crop Bulletin-----	19
Pacific Coast Weather Bulletin-----	20
Influence of Japan Current upon Climate of Oregon and Washington---	21
The Weather Service Prof. F. E. Nipher-----	22-27

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# BULLETIN FOR FEBRUARY 1891.

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## CROP-WEATHER CORRESPONDENTS.

NOTE.—During the month preparations were made to secure a large corps of crop-weather correspondents for the coming growing season. Producers, merchants and citizens in every locality of the State were addressed, and the favorable replies received indicate a growing interest in the work of this bureau. The first weekly bulletin of this year will be issued on the 14th prox.

## THE LEGISLATURE.

The legislature which closed its labors on the 21st inst. appropriated a sum of \$2,000 to further carry on the work of this bureau, to purchase instruments and extend the scope of operations. The senate committee on agriculture, consisting of Senators Looney, Norval and Veatch, to whom was referred the biennial report of this bureau for examination and report, made a very favorable report and commended the work being done. A large number of additional instruments will be purchased and distributed throughout the State within the next six months. Voluntary observers are especially desired in Eastern Oregon.

## AGRICULTURAL COLLEGE BULLETINS.

The State agricultural college and Oregon experiment station at Corvallis issue bulletins on various subjects kindred to agriculture. These bulletins are gratuitously distributed to those requesting them. They are of especial value to those in any way interested in agricultural pursuits, and a postal card addressed to "State Agricultural College, Corvallis, Oregon," requesting copies of the bulletins issued will secure them. The farm has no more valuable adjunct than this college, its work and its bulletins.

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## GENERAL WEATHER CONDITIONS.

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The marked characteristics of the month were the low barometric pressure on the 23d, the deficiency in temperature and the excess in precipitation. The

month opened with cold winds, and it remained cool the entire month. The rainfall was quite heavy in Western Oregon, the snowfall heavy in Eastern Oregon, especially during the last week of the month. The autumn and winter to February 1 was unusually mild and dry; the fruit buds were swelling, blossoms and leaves were reported in January. Grass grew finely, and there was an absence of frost in the ground up to the present month.

The conditions during the month were very beneficial to crops; fruit buds were retarded; the rain soaked the soil and when the snow in Eastern Oregon melts the moisture will penetrate the soil, furnishing favorable conditions for crop prospects the coming season. The low barometric pressure on the 23d—the reduced barometer being about 29.00 inches—was very unusual; such a low pressure has not occurred since the snow storm of January, 1880. The result of this low pressure was general rain or snow and brisk winds. This storm moved eastward across the continent giving precipitation in its path.

## BAROMETRIC PRESSURE.

*(Reduced to sea level.)*

The pressure was slightly below the normal. The highest, 30.563 inches, is reported from Portland on the 8th. The lowest, 28.939 inches, is reported from Baker City on the 23d. The highest generally occurred on the 8th, the lowest on the 23d. The high was accompanied by fair weather, the low was preceded and followed by general rains or snow.

## TEMPERATURE.

*(Expressed in degrees and tenths, Fahr. scale.)*

The mean of the State for February, 1891, is 35°.8, which is on an average 2°.7 below the February normal. The mean was slightly higher than the corresponding month of 1890. The mean and the deficiency for the various districts are as follows:

District.	Mean.	Deficiency.
Coast	40.9	—1.5
Willamette Valley	36.8	—2.8
Southern Oregon	38.4	—3.0
Eastern Oregon	26.9	—3.5

The greatest deficiency, 8°.1, is reported from Walla Walla; the least, 0°.1, from Gardiner.

Bandon reports the highest mean, 41°.4, and Joseph the lowest, 19°.6. West of the Cascades the mean ranged from 35° to 44°; east of them from 20° to 33°.

The maximum generally occurred on the 18th; the highest maximum, 59°, is reported from Gardiner.

The minimum generally occurred on the 2d; the lowest minimum, 11° below zero, is reported from Baker City.

The mean maximum in Western Oregon was above 40°; in Eastern Oregon generally above 32°; the highest, 48°.4, is reported from Toledo; the lowest, 28°.9, is reported from Joseph.

The mean minimum was generally below the freezing point. Those places having a mean minimum above 32° were along the immediate coast and at Albany, Eugene and Roseburg.

The highest mean minimum, 40°.6, is reported from Bandon; the lowest, 10°.3, from Joseph.

The temperature was below 40° every day of the month at all stations except at Gardiner, Bandon and Roseburg.

Zero temperature, or below, occurred east and south of the Blue mountains.

Freezing temperature, or below, occurred at every station.

## PRECIPITATION.

*(In inches and hundredths, including rain, melted snow, sleet and hail.)*

The average precipitation for the State for the month, 6.82 inches, is 1.78 inches above the February average. The greatest excess is in Southern Oregon, the least in Eastern Oregon. The average and excess for the various districts are as follows:

District.	Average.	Excess.
Coast.....	9.85	1.11
Willamette Valley.....	6.43	1.55
Southern Oregon.....	7.40	3.66
Eastern Oregon.....	3.59	0.80
The State as a whole.....	6.82	1.78

Bandon reports the greatest monthly amount, 14.06 inches, and Pendleton the least, 2.16 inches.

The greatest excess, 6.89 inches, is at Roseburg. The total amount was deficient at Astoria, Portland, East Portland and Cascade Locks; at all other stations there was an excess.

From July 1, 1890, to the 28th of February, 1891, inclusive, the total precipitation amounted to from 30 to 34 inches along the coast, which is a deficiency



of from 14 to 21 inches. In the Willamette valley the total amounts to from 16 to 25 inches, which is a deficiency of from 5 to 17 inches. In Southern Oregon the total is from 11 to 20 inches, a deficiency of from 3 to 5 inches; in Eastern Oregon the total is from 5 to 14 inches, which is a deficiency of from 1 to 6 inches. At Gardiner, 34.26 inches fell, the greatest amount for the season, at Happy valley (Diamond P. O.) 4.55 inches fell, the least amount. The greatest deficiency, 21 inches, is at Astoria; the least, 2.08 inches at La Grande.

The snowfall for the month was above the average. Snow fell in every district, from a trace along the coast to 46 inches at Hood river. Most of it fell during the latter part of the month. In Western Oregon it did not remain on the ground for more than a few days at the most, except in sheltered places and on the higher elevations where a trace remained for about ten days. At the close of the month snow covered the ground of Eastern Oregon at depths of from a few inches to a foot, dependent upon locality and elevation; in the mountains from 6 to 10 feet fell, and at close of month most of it remains on the ground, while at many places over one inch of rain fell in 24 consecutive hours, still no station reports excessive precipitation, 2.50 inches in 24 consecutive hours.

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## WINDS.

*(Velocity from self-registering anemometers.)*

The prevailing direction of the wind was southwest. The velocity was generally light. Maximum velocity of from 20 to 30 miles are reported from the various stations, except Fort Canby, where 64 miles an hour occurred on the 12th. The average hourly, in miles and tenths, was as follows: Fort Canby, 11.1 miles; Portland, 5.6; Forest Grove, 1.7; Corvallis, 6.6; Eugene, 6.2; Roseburg, 3.2; Walla Walla, 5.9; Spokane Falls, 4.2; La Grande, 2.2; Baker City, 5.5 miles.

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## WEATHER.

Rain fell on 70 per centum of the days of the month; 72 per centum of the days were cloudy and 28 per centum partly cloudy or cloudless. On the 2d, 3d and 8th there was a general absence of rain or snow; on the other dates precipitation occurred at some place within the State. The greatest number of cloudy days, 24, is reported from Bandon; the least number, 5, from Lakeview. The greatest number of cloudless days, 9, is reported from Happy Valley; the least number, none, at Forest Grove, Eugene and Grant's Pass.



The weather stopped the advancement of fruit buds and generally retarded vegetation. The moisture in the ground, however, is favorable for the crop outlook.

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## MISCELLANEOUS DATA.

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### FROSTS.

Frosts were general, but did no injury. There were but a few days when frost was in the earth, hence little, if any, damage was done to the fall-sown grain.

### THUNDER.

Thunder was heard at Bandon, Vernonia and Ashland.

### HAIL.

Hail fell at Albany, Eugene and Heppner.

### HALOS.

Solar or lunar halos were seen at East Portland, Hubbard, Albany, Grant's Pass, Hood River, The Dalles, Lone Rock and Heppner.

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## CORRESPONDENTS' REMARKS.

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### COOS COUNTY.

Bandon.—Snow on 23d; came in the form of sleet and remained about half an hour before it melted. It measured .06 of an inch.

### COLUMBIA COUNTY.

Vernonia.—This month was 1°.2 warmer than February, 1890, and 5°.8 colder than January, 1891 (last month.) This month had 2.57 inches less rainfall than February, 1890. At least three feet of snow has fallen this month, but it melted as it fell, so much so that it was impossible to measure it with any accuracy. The deepest that it lay on the ground at one time was eighteen inches on the morning of the 22d.

Deer Island.—Month has been cold, cloudy and cheerless. Buds that were partly open on the first of the month have made but little advance. Cattle had to be housed and full fed all month. Wind at noon and early P. M. of 14th and 15th blew from east, strong enough to blow down dead timber.

### MULTNOMAH COUNTY.

East Portland.—February has outdone January so far as rain, snow and frost are concerned, and on the whole has been a cold month. Rain and snow

on eighteen days; total amount of rain and melted snow, 3.54 inches; largest rainfall at one time, from 6 P. M. on the 12th to 6 A. M. on the 13th, 2 inches; snow to the depth of  $4\frac{1}{2}$  inches fell on the night of the 23d; on the 6th at 5:30 P. M. we had a heavy storm of rain, hail and snow; on the 1st at sunset two fine parhelia S. E. and N. W. of sun, followed by a cold wave on the 2d; highest temperature,  $51^{\circ}$  on the 17th; lowest temperature,  $20^{\circ}$  on the 2d; solar halo on the 3d. It is impossible to tell the total amount of snowfall owing to the fact that rain and snow fell at the same time. A large number of plants and flowers that commenced growing in January have been killed by the frost of this month. Ozone 7% per day for the month; prevailing diseases, scarlet fever and pneumonia, with a few cases of catarrhness epidemicus.

#### YAMHILL COUNTY.

McMinnville, February 6.—The Coast mountains west of this place are again white with snow, the snow reaching down to within perhaps 800 feet of the level of the valley. A little snow fell here but melted on touching the ground. February 8.—The surface of the ground was frozen last night, and this morning enough snow fell to whiten the earth. This is the first snow of the winter; it soon melted away. February 13.—Snow began falling at 3 A. M., and by noon it lay on the ground to the depth of 4 inches; afternoon it turned into a drizzling rain, and by 6 P. M. the snow was nearly all gone. February 16 to 26, inclusive.—Rain or snow fell nearly all the time, the snow melting as it touched the earth. February 22.—The lowest barometer I have ever noted here: daily mean, 28.980.

#### MARION COUNTY.

Hubbard.—The general health of the community is good. There are still a few cases of measles in the neighborhood. Winter-sown grain is looking well. Stock that have been sheltered are looking well; those unsheltered are getting thin. It is cruel to keep stock and let them stand in the cold rains without shelter except that furnished by a rail fence or the more friendly bows of a fir tree.

#### POLK COUNTY.

Eola.—It is estimated that about 12 inches snow has fallen here, but so much of it was mingled with rain and largely melting on reaching the ground that it could only be measured as water. The weather conditions for the month have been favorable to farming operations in the main, consequently but little has been done, and the farmers are hoping for favorable weather in March to again start the plow. So far stock are coming through in fair condition. The barometer (aneroid) has been unusually low during the latter half of the month. As the month closes it is 29.08. Wheat promises to come on favorably with warmer weather, which is also needed to start the grass. February 22 aneroid barometer went down to 28.50; February 23 aneroid barometer went down to

28.52; February 24 aneroid barometer went down to 29.34; February 25 aneroid barometer went down to 29.60.

## MARION COUNTY.

Mount Angel.—Twenty-first, light snow the whole day and night; the same on the 22nd, the snow melting as it fell; 23d, snow lying whole day on the ground; 24th, all snow gone by evening.

## LINN COUNTY.

Albany.—Third, heavy hoar frost; 6th the same, also 7th and 8th; 9th, snow gone before noon; 11th, high winds followed by rain; 13th, rain and snow; 14th, lightning, no thunder heard, lunar halo; 15th, light frost; 16th, hoar frost, lunar halo; 19th, rain and snow melted as it fell; 20th, rain and snow melting before night; 21st, rain and snow melted as it fell; 22d, sleet, rain and snow; 23d, snow gone before night; 24th, hoar frost; 25th, zodiacal light about 25° altitude, 7 to 9 P. M., at a low tangent to south; 27th, snow and rain; 28th, 4 A. M., high wind followed by sleet.

Deviations from normal precipitation and temperature: Average rainfall for February, 12 years, 7.07; rainfall for February, 1891, 7.73; this being 0.66. Greatest in 1881, 13.08; least in 1889, 0.95. Mean temperature for February, 12 years, 40.3; mean temperature for February, 1891, 37.4, minus 2.9. Highest temperature in 1881 and 1886, 46.5; lowest in 1887, 32.7.

## LANE COUNTY.

Eugene, University of Oregon.—Snow fell on the following dates: On the night of the 7th a light snow, the first of the season; on the 17th a light shower; on the 19th about an inch deep, this disappeared by noon of the 20th; on the night of the 21st, 4.1 inches, this disappeared by the 25th; on the night of the 26th, .6 of an inch, this disappeared by the 27th. Snow lay upon the surrounding hills continuously after the 12th. The month closed in the severest snow storm of the season. Snow began falling between 9 and 10 o'clock Saturday night and fell unceasingly until about 4:30 o'clock P. M. the next day. The total amount which fell was 7½ inches which lay upon the ground in exposed places until March 5, and is not yet entirely gone from the surrounding hills. This storm was conspicuously devoid of wind, the anemometer registering so small an amount as two miles during twenty-four hours. About 12 midnight of the 1st the thermometer reached the lowest point which it has reached during the present season, viz.: 19° above zero. Crocuses and the wild grape in bloom on the 14th. Mornings of the 3d and 5th foggy.

## JACKSON COUNTY.

Jacksonville.—This has been a stormy month, cloudy and wet most of the time, but not very cold. Violets are in full bloom here. The grass is starting finely and the valley and surrounding hills begin to look green. A few bright warm days would bring the almond and peach trees into full bloom. The

last day of the month was the first real spring day this year; although cloudy, it was warm and pleasant, and the frogs turned out for the first time with a full chorus and croaked quite diligently all day and in the evening. Total rainfall since September 30, 12.42 inches.

Ashland.—For the month a temperature considerably below the normal and double the normal precipitation. No blossoms have appeared on nut or fruit trees. Rain and snow has been well distributed through the month and the soil has absorbed most of it.

GILLIAM COUNTY.

Lone Rock.—There has been snow on the ground since the first of the month, causing stockmen to feed all the time. The total snow fall has been 36 inches, although it did not get to be over 18 inches at any one time, as the ground was not frozen when it began to snow a great portion of it melted from the warmth of the soil.

There is a heavy snowfall in all the high mountains, insuring plenty of water in the small streams next summer. Stock have not suffered for the want of feed so far, and will not because there was no snow before this month, and stock were fat and the feed was not needed, leaving plenty for February and March.

Total rainfall for the month, three inches. Maximum temperature, 43° on the 4th; minimum temperature, 2° on the 28th; mean, 27°; wind, SW and E. Greatest variation of temperature, 30° on 4th. The turtle doves have made their appearance earlier than usual (not coming until April as a rule.)

MORROW COUNTY.

Heppner.—The past month has been a most favorable one for both the stockman and farmer. The snow kept thawing as fast as it fell, so that at no time was there more than 5 inches on the ground, and it all went into the ground, which will insure good grass and crops; we had 2.90 inches. Stock had, therefore, a good show to stay on the range and get grass. Very little feeding has been done. South of here, however, there has been about 12 inches of snow at one time. The weather, also, has been quite mild, the thermometer not having gone as low as 6 above, except on two occasions. Stock, therefore, have not suffered any, and there have been no losses this winter.

Hardman.—February 1 was the coldest day during the month, and on the last day we had the heaviest fall of snow—10 inches. Depth of snow at close of month, 30 inches. Winter, long deferred, came at last in good earnest, and stockmen need all their feed. Hay sold at \$8 per ton at the beginning of the month; now it is \$10. The cold has not been extreme; lowest temperature, 7°, and highest, 46°; mean, 24°.6. Stock have not suffered, there being plenty of hay and straw. No high winds, except a blizzard on the 6th and another on the 11th; the days have been mostly cloudy, with three foggy; total snowfall for February, 2 feet and 9½ inches; ground was not frozen at time of snowfall,



so farmers rejoice in hopes of bountiful crops next season.

UMATILLA COUNTY.

Pendleton.—The evenness of the temperature of February is one of its most marked features, the greatest range for the month being  $27^{\circ}$  less than February, 1890, while the general average for the month is only  $0^{\circ}.29$  less. The precipitation, 2.16 inches, is perhaps above the average for this locality. The ground is well wet down  $1\frac{1}{2}$  feet, and the farmers are much cheered at the prospect for a crop. There are 5 inches of snow on the ground here, and still more than that on the farming land all around. Seven feet of snow are reported in the mountains adjacent and increasing all the time. The fruit looks uninjured, even peaches seem all right; still as we are now having cold weather we can not be quite certain about the fruit.

UNION COUNTY.

Telocaset.—16, snow-storm from the north; 21, saw first flock of wild birds; 22, a thaw commenced but lasted only 24 hours.

MALHUR COUNTY.

Beulah.—February has been unusually wet with but few clear days. Snow and rain every few days. Snow would fall to the depth of three to four inches and would go off in two or three days, and then snow again. We have, however, got through very well. Stock are in good condition. Haven't heard of any stock dying this winter, as the south hillsides have been bare all winter except at one or two days at a time. We expect spring soon, as the days are getting warmer, but the nights are cool. The snow in the mountains is reported deep. We expect plenty of water next summer. The ground was frozen to a depth of five or six inches before we had any snow, therefore when the snow melts the water cannot get into the ground.

HARNEY COUNTY.

Happy Valley.—February came in with a snow storm, and the month throughout has been very stormy and windy; in short, has been one continual storm. Snow has covered the ground most of the time, reaching a depth of 11 inches on the 16th. The precipitation, 2.70, is the greatest monthly since the station was established, and exceeds that of the preceding six months combined. A chinook is blowing at the close of the month and the snow is rapidly disappearing.

LAKE COUNTY.

Silver Lake.—During the month there has been considerable wet weather. Reports from surrounding mountains indicate that the snow is very deep, and that the prospects are that there will be plenty of water for irrigation purposes this summer. Our winter has been very light up to the present. Not much feeding of stock was done until the present storm. General health of the people is good. One case of fever, during the month, bordering on typhoid.

TABLE GIVING AVERAGE DATA.

The following table gives the average data for each hour of the day, local time, from self-registering instruments, at the places named, during the month of February, 1891.

Data.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.
Mean actual barometric pressure at Portland	29.796	29.795	29.790	29.785	29.780	29.777	29.782	29.786	29.794	29.798	29.816	29.814
Mean actual barometric pressure at Forest Grove												
Mean actual barometric pressure at Corvallis	29.65	29.64	29.64	29.64	29.63	29.63	29.64	29.65	29.66	29.68	29.69	29.68
Mean temperature at Portland	35.3	34.9	34.8	34.4	34.0	33.9	34.1	34.2	34.9	36.3	37.4	38.9
Mean temperature at Corvallis	34.0	33.9	33.8	33.8	33.8	33.5	33.2	33.3	33.6	34.6	35.5	36.5
Mean temperature at Eugene	36.1	35.9	35.6	35.6	35.5	35.2	35.1	35.2	36.5	38.1	39.3	40.5
Mean temperature at Roseburg	36.5	36.5	36.2	36.1	36.0	35.9	35.9	35.6	36.2	37.4	38.9	40.3
Mean temperature at Walla Walla												
Mean temperature at Baker City												
Average movement of wind, in miles and tenths, at Portland	5.2	4.8	4.9	4.5	4.4	4.4	4.7	4.8	5.1	6.2	6.3	6.5
Average movement of wind, in miles and tenths, at Forest Grove	1.3	1.7	1.8	1.3	1.2	1.0	1.1	1.2	1.6	1.5	2.0	1.9
Average movement of wind, in miles and tenths, at Corvallis	6.4	6.0	5.7	5.6	5.2	5.3	5.5	6.0	5.1	5.7	7.1	7.5
Average movement of wind, in miles and tenths, at Eugene	7.3	7.6	6.8	6.8	7.1	7.1	7.1	6.3	7.6	8.3	8.9	9.7
Average movement of wind, in miles and tenths, at Roseburg	2.6	2.3	2.5	2.8	2.5	2.5	2.6	2.3	2.4	3.3	3.3	3.9
Average movement of wind, in miles and tenths, at Walla Walla												
Average movement of wind, in miles and tenths, at Baker City	5.1	5.5	5.0	4.9	5.9	5.3	5.2	5.5	5.5	5.7	6.1	5.6



TABLE GIVING AVERAGE DATA—CONCLUDED.

Data.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Mid- night.	Av. for month.
Mean actual barometric pressure at Portland	29.804	29.794	29.789	29.786	29.781	29.787	29.791	29.796	29.802	29.802	29.802	29.800	29.795
Mean actual barometric pressure at Forest Grove													
Mean actual barometric pressure at Corvallis	29.67	29.66	29.66	29.66	29.66	29.66	29.66	29.66	29.65	29.65	29.65	29.65	29.655
Mean temperature at Portland	39.4	40.0	40.0	39.9	38.8	37.8	37.1	36.4	36.0	35.9	35.7	35.5	36.5
Mean temperature at Corvallis	37.2	38.0	38.2	38.1	37.6	36.8	35.9	35.6	35.4	35.0	34.8	34.1	35.3
Mean temperature at Eugene	41.4	41.5	41.1	41.0	39.6	39.0	38.1	37.5	36.9	36.5	36.4	36.3	37.6
Mean temperature at Roseburg	42.1	42.8	43.4	43.6	43.7	42.5	40.9	39.7	38.9	37.7	37.3	36.8	38.8
Mean temperature at Walla Walla													
Mean temperature at Baker City													
Average movement of wind, in miles and tenths, at Portland	7.0	6.8	6.9	7.0	7.0	6.1	5.8	5.6	5.4	5.2	5.3	5.4	5.6
Average movement of wind, in miles and tenths, at Forest Grove	1.2	1.3	1.7	1.9	1.9	2.0	2.3	2.0	2.1	2.3	1.8	1.7	1.7
Average movement of wind, in miles and tenths, at Corvallis	8.6	8.3	8.4	8.7	8.9	7.5	6.9	6.6	6.0	6.0	5.9	6.3	6.6
Average movement of wind, in miles and tenths, at Eugene	9.2	8.7	8.5	8.3	7.6	6.8	6.0	6.6	6.6	7.0	7.2	7.1	7.6
Average movement of wind, in miles and tenths, at Roseburg	4.8	5.1	4.6	5.0	5.1	4.2	3.5	2.9	2.4	2.2	2.2	2.0	3.2
Average movement of wind, in miles and tenths, at Walla Walla													
Average movement of wind, in miles and tenths, at Baker City	6.0	6.4	6.2	6.1	6.1	5.0	4.6	4.9	5.4	5.3	5.3	5.1	5.5

## VELOCITY AND DIRECTION OF WIND AT PORTLAND.

Table showing total number miles of wind and the number of hours and minutes that the wind blew from each point of the compass during February, 1891, as recorded at central office, Portland, Or. In obtaining this data velocities of less than four miles an hour are considered as calm.

1891.	North.		Northeast.		East.		Southeast.		South.		Southwest.		West.		Northwest.		Calm.	
	Miles.	Hours and min.	Miles.	Hours and min.	Miles.	Hours and min.	Miles.	Hours and min.	Miles.	Hours and min.	Miles.	Hours and min.	Miles.	Hours and min.	Miles.	Hours and min.	Miles.	Hours and min.
February.																		
Total	89	12:30	312	38:35	142	20:45	130	17:50	1884	180:20	247	29:35	54	6:50	210	21:25	716	344:00
Percentage	2	2	8	6	4	3	3	3	50	27	7	4	1	1	6	3	19	51

From the above data the average time the wind blew from each point of the compass to record one mile, was as follows: North, one mile in 8 minutes; northeast, one mile in 7 minutes; east, one mile in 9 minutes; southeast, one mile in 8 minutes; south, one mile in 6 minutes; southwest, one mile in 7 minutes; west, one mile in 8 minutes; northwest, one mile in 6 minutes; calm, one mile in 29 minutes; i. e., when the wind was from the south during February, 1891, it had the highest average velocity (one mile in 6 minutes, or an average of 10 miles per hour.) When the wind direction was from the east it had the least average velocity, one mile in 9 minutes or 7 miles per hour. The average hourly velocity for calm was 2 miles.

## SOIL TEMPERATURE AT PENDELETON.

Table showing daily maximum, minimum and mean air temperature at Pendleton, Oregon, during February, 1891; also the daily temperature of the soil at depths of 1, 8, 12 and 24 inches below the surface, together with the total daily precipitation. Soil thermometer observed at 3 P. M. daily.

Data.		February, 1891.																												Avg.
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
Maximum temperature-----		27	24	25	33	42	43	41	39	40	44	50	52	43	45	31	32	35	49	44	44	45	29	39	32	42	38	29	23	
Minimum temperature-----		2	2	4	6	28	33	28	18	23	33	33	30	33	33	21	20	21	27	31	32	28	20	19	17	16	24	17	6	
Mean temperature-----		14	13	14	20	35	38	35	28	31	38	42	41	38	39	27	26	28	38	38	36	21	29	24	29	31	26	14		
Soil temperature, depth of 4 inches-----		31	33	31	30	32	32	32	32	32	33	36	38	40	34	34	33	33	35	37	38	37	34	33	34	33	33	33		
Soil temperature, depth of 8 inches-----		37	35	34	32	33	33	33	34	34	34	36	36	38	38	36	35	34	34	36	36	35	35	34	34	34	34	33		
Soil temperature, depth of 12 inches-----		40	38	37	36	35	35	35	36	35	36	36	36	38	38	38	37	36	36	37	37	37	37	36	36	36	36	35		
Soil temperature, depth of 24 inches-----		41	41	40	40	39	39	38	38	38	38	38	38	38	38	39	39	38	38	38	38	38	38	38	38	38	37	37		
Total precipitation-----		*10				*02				.05	.38	.01		.82			* T					*36			*03	* T	.24	*10		
																													2.16	

\*Melted snow.



ry, 1891.

Winds: Velocity in Miles.					Number of Days				Number of						Names of Observers.
Average Hourly Velocity for Month.	Maximum Velocity.			Prevailing Direction.	On which .01 inch or more of rain fell.	Cloudy.	Partly Cloudy.	Cloudless.	Hail Storms.	Thunder Storms.	Solar Halos.	Lunar Halos.	Light Frosts.	Killing Frosts.	
	Miles per Hour.	Direction from.	Date.												
11.1	64	SW	Feb. 12	SE E	23 23	15 19	10 4	3 5				1	7	7	J. H. Young. John Grover.
				SE S	24 20	19	6	3							Geo. Hunt, L. H. Keeper. Dr. H. W. Vincent.
				SW&W	22 24					1			7		J. S. Gray. George Bennett.
				SE SW E S	20 21 17 22					1					Hospital Corps, U. S. A. G. W. Dallas. John McDonald.
5.4	30	S	12	S	22	19	5	4					1		B. S. Pague. Dr. Geo. Wigg.
1.7	18	S	18	N S S S	18 23 23 22	23 19 19	5 6 7	3 3 1			3				G. W. Shaw. Wyatt Harris.
				W&N SW SW S S	22 19 15 20 20	13 24 14 19 22	11 3 9 7 6	4 1 5 2			1	1		3	W. H. Goudy. Dr. U. Fisher, O. S. B. Thomas Pearce.
6.6													14		W. A. Lampkin. John Briggs.
6.2	29	S	12	S					1			2	6		S. E. McClure, A. M.
3.2	28	S	12	SW	22	19	6	3					2		Thomas Gibson.
				SW W NW	12 19 16	10 14 15	3 9 9	5 4				1	11 13		John B. Paddock. Peter Britt. F. H. Carter.
				W	21	20	5	3							U. S. Engineer Corps.
	20	E	26	W E	17 14	18 12	6 8	4 8			1 2		2		P. S. Barrett. Samuel L. Brooks.
				SW W	14 20						2	1 2	28		W. H. Colwell. Arthur Smith.
				S&SW SW	14 10	23 11	1 9	4 8					28		Mrs. E. E. Bleakman P. Zohner.
5.9 4.2	30 24	SW SE	11 19	SW SW SW	14 17 16	10 16 7	15 11 16	3 1 5							William Bell. Charles Stewart. J. D. McCully. J. K. Romig.
2.2					8	13	10	5							Wm. C. Cusick.
5.5	25	SW	13	SE	14 16 10	21 18	2 5	5							C. H. Stuller. T. L. Arnold.
				SW SW S	10 10 15	12 19 5	7 3 15	9 6 8							J. H. Neal. F. W. Chrisman. S. C. Beach.



# TABLE N

## Miscellaneous Meteorological Data for

DISTRICT, STATION AND COUNTY.	Elevation above Mean Tide Level.	Atmospheric Pressure.					Temperature of the Air (in degrees and tenths, Fahrenheit's Scale.)												Precipitation.
		Mean Reduced Barometer.	Highest Barometer.	Date.	Lowest Barometer.	Date.	Monthly Mean.	Departure (plus or minus) from the Average.	Maximum.	Date.	Minimum.	Date.	Range.	Mean Maximum.	Mean Minimum.	Number times temp're reached		Total Precipitation.	
																90° or above.	40° or below.		
COAST—																			
Fort Canby, Wash.....	179	29.820	30.516	Feb. 8	28.978	Feb. 23	38.9	— 3.1	47	Feb. 11	30	Feb. 2	45	43.8	34.0	0	28	5.99	
Astoria, Clatsop county.....	38						39.4	— 1.9	50	Feb. 28	29	Feb. 2	21	45.1	33.6	0	28	8.01	
Tillamook, Tillamook county.....	10																	7.11	
Tillamook Rock L. H. (in ocean).....																		11.06	
Toledo, Benton county.....	30						39.7	— 1.7	54	17	28	3, 8	26	48.4	31.0	0	28	12.88	
Gardiner, Douglas county.....	12						42.0	— 0.1	59	10	30	9	29	47.7	36.3	0	25	14.06	
Bandon, Coos county.....	55						44.4	— 0.9	53	3	32	8	21	43.2	40.6	0	14		
Gold Beach, Curry county.....	60																		
WILLAMETTE VALLEY—																			
Vancouver Barracks, Wash.....	68						35.8	— 4.4	49	27	20	2, 3	29	42.0	29.5	0	28	4.37	
Vernonia, Columbia county.....							34.7		45	7	22	2	23	40.7	31.2	0	28	7.29	
Deer Island, Columbia county.....	150																	5.21	
Portland, Multnomah county.....	80	29.870	30.563	8	29.075	23	37.0	— 4.6	48	18	25	2	23	42.3	31.7	0	28	6.26	
East Portland, Multnomah county.....	75						51		19	20	20	2	49					3.54	
Forest Grove, Washington county.....	229						38.4		48	6	20	2	28	46.5	30.2	0	28	5.04	
*McMinnville, Yamhill county.....	180	29.695	30.300	8	28.980	22	36.6	— 2.9	50	10	22	3	28	42.6	30.6	0	28	6.58	
Hubbard, Marion county.....	270						37.0		50	18	20	2	30	44.1	30.0	0	28	6.18	
Mt. Angel, Marion county.....	140						36.6	— 2.2	49	18	22	2	27	42.9	31.7	0	28	5.76	
Eola, Polk county.....	500						35.9	— 1.7	48	10	19	3	29	41.4	29.0	0	28	7.90	
*Corvallis, Benton county.....	150	29.66	30.31	8	28.71	22	36.2	— 1.5	48	1, 10	22	8	26	41.9	30.4	0	28	7.82	
*Albany, Linn county.....	224	29.73	30.04	8	29.36	23	38.0	— 2.6	50	18	27	2, 3	23	42.3	33.6	0	28	7.73	
*Eugene, Lane county.....		29.436	30.084	8	28.710	23	38.4		50	1	27	16	23	43.4	33.5	0	27	9.97	
UMPUVA VALLEY—																			
Roseburg, Douglas county.....	523	29.918	30.520	8	29.107	22	39.8	— 2.4	51	1	24	9	42	44.9	34.7	0	26	11.50	
ROGUE RIVER VALLEY—																			
Grant's Pass, Josephine county.....	964						38.4		54	28	24	23	30	45.6	31.1	0	28	7.55	
Jacksonville, Jackson county.....	1640						37.8	— 2.6	54	14	19	9	35	45.8	29.9	0	28	6.11	
Ashland, Jackson county.....	1940						37.4	— 3.9	57	12	18	9	39	45.3	29.4	0	28	4.43	
EASTERN OREGON—																			
Cascade Locks, Wasco county.....	125		30.450	8	29.150	23												9.69	
Hood River, Wasco county.....																			
*Hood River, Wasco county (5 mi. S. of)	920	29.03	29.73	8	28.00	21	30.8		43	18	12	3	31			0	28	6.70	
*The Dalles, Wasco county.....	116	29.621	30.55	8	29.08	23	32.6	— 3.3	47	6, 18	10	28	37	40.3	25.0	0	28	2.47	
Grass Valley, Wasco county.....																			
Dufur, Wasco county.....																			
Lone Rock, Gilliam county.....	2000						25.5	— 1.7	43	4	2	28	41	35.0	16.0	0	28	3.01	
*Heppner, Morrow county.....	1950	27.85	29.63	25	27.41	13	29.4	— 0.6	46	4, 21	6	24, 28	40	38.4	20.4	0	28	2.99	
Alpine, Morrow county.....																			
Hardman, Morrow county.....							25.4		46	26	7	1, 27, 28	39	32.9	17.9	0	28	3.38	
Pendleton, Umatilla county.....	1122						29.8	— 0.3	52	12	2	1, 2	50	37.9	21.7	0	28	2.16	
Weston, Umatilla county.....	1809																		
Walla Walla, Wash.....	1018	29.948	30.580	8	29.221	23	30.3	— 8.1	50	12	6	28	44	37.2	23.4	0	28	2.70	
Spokane Falls, Wash.....	1909	29.956	30.573	8	29.143	23	25.2	— 3.3	38	12, 19, 21	1	27	37	32.6	17.7	0	28	2.40	
Joseph, Wallowa county.....	4400						19.6	— 3.3	44	23	10	2	54	28.9	10.3	0	28	3.12	
La Grande, Union county.....	2784						27.4	— 3.5	49	22	9	21	40	35.2	19.5	0	28	3.34	
Summerville, Union county.....																			
Telocaset, Union county.....	3419																	2.81	
North Powder, Union county.....	3350																		
Baker City, Baker county.....	3410	29.966	30.527	3	28.939	23	22.6	— 5.1	48	13	— 11	2	59	33.2	12.1	0	28	2.59	
Huntington, Baker county.....	2110																		
Beulah, Malheur county.....	4400						23.8	— 5.2	51	22	— 9	8	60	35.6	11.9	0	28	3.09	
Jordan Valley, Malheur county.....	4450																		
Burns, Harney county.....																			
Happy Valley, Harney county.....							26.7		50	22	— 6	8	56	35.9	17.5	0	28	2.70	
Silver Lake, Lake county.....	4300						27.0		49	22	— 3	8	52	39.3	14.7	0	28	3.08	
Lakeview, Lake county.....	4200						28.1	— 3.7	46	3, 27	— 4	18	50	38.5	17.7	0	28	4.95	

\*Actual Barometer Readings.

‡Officers U. S. Signal Service.



D. 1.

Month of February, 1891.

Rain, Melted Snow, Sleet and in Inches and Hundredths.					Winds: Velocity in Miles.					Number of Days				Number of						Names of Observers.
Total from July 1, 1890, to Feb. 28, 1891, inclusive.	Average from July 1 to Feb. 28, inclusive.	Departure (plus or minus) from the Average.	Total depth of unmelted snowfall in in. & 10ths.	Total Movement in Miles during Month.	Average Hourly Velocity for Month.	Maximum Velocity.			Prevailing Direction.	On which .01 inch or more of rain fell.	Cloudy.	Partly Cloudy.	Cloudless.	Hail Storms.	Thunder Storms.	Solar Halos.	Lunar Halos.	Light Frosts.	Killing Frosts.	
						Miles per Hour.	Direction from.	Date.												
25.53	30.85 33.84	48.59 54.81	— 17.74 — 20.97	—	7438	11.1	64	SW	Feb. 12	SE E	23 23	15 19	10 4	3 5	—	—	—	1	7 8	J. H. Young. John Grover.
—	—	—	—	—	—	—	—	—	—	SE S	24 20	19	6	3	—	—	—	—	—	Geo. Hunt, L. H. Keeper. Dr. H. W. Vincent.
.98 .24	34.26 29.78	53.03 44.07	— 18.77 — 14.29	0 †	—	—	—	—	—	SW & W	22 24	—	—	4	—	1	—	—	7	J. S. Gray. George Bennett.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
.83	16.33 25.06	27.40	— 11.07	6.1 36.0	—	—	—	—	—	SE SW E	20 21 17	—	10 19 8	— 5 1	—	1	—	—	—	Hospital Corps, U. S. A. G. W. Dallas.
.34	18.33	35.02	— 16.69	28.0 11.4	3784	5.4	30	S	12	S	22	19	5	4	—	—	—	—	1	John McDonald. B. S. Pague.
.85	9.99	22.53	— 12.64	4.5	—	—	—	—	—	N	18	23	5	—	—	—	3	—	—	Dr. Geo. Wigg.
.35	18.39	—	—	3.5	1122	1.7	18	S	18	SW S	23 22	19 20	6 7	3 1	—	—	1	—	—	G. W. Shaw. Wyatt Harris.
.70	20.53	26.23	— 5.70	5.5	—	—	—	—	—	W & N	22	13	11	4	—	—	—	—	3	W. H. Goudy. Dr. U. Fisher, O. S. B.
.99	18.45	—	—	3.5	—	—	—	—	—	SW	19	24	3	1	—	—	—	—	14	Thomas Pearce.
.37	17.88	—	—	4.0	4455	6.6	—	—	—	SW	15	14	9	5	—	—	—	—	—	W. A. Lampkin.
.36	20.16	33.61	— 13.45	2.2	—	—	—	—	—	S	20	19	7	2	1	—	—	2	6	John Briggs.
—	20.15	30.34	— 10.19	5.7	4197	6.2	29	S	12	S	20	22	6	—	1	—	—	—	5	S. E. McClure, A. M.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
.89	20.03	25.56	— 5.53	†	2156	3.2	28	S	12	SW	22	19	6	3	—	—	—	—	2	Thomas Gibson.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
.87	14.44	—	—	7.8	—	—	—	—	—	SW	12	10	3	—	—	—	—	1	—	John B. Paddock.
2.21	12.88	17.31	— 4.43	9.5	—	—	—	—	—	W	19	14	9	5	—	—	—	—	11	Peter Britt.
—	10.57	14.07	— 3.50	8.6	—	—	—	—	—	NW	16	15	9	4	—	1	—	—	13	F. H. Carter.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
.89	35.79	60.78	— 24.99	†	—	—	—	—	—	W	21	20	5	3	—	—	—	—	—	U. S. Engineer Corps.
2.20	14.90	17.34	— 2.44	46.2	—	—	—	—	—	W	17	18	6	4	—	—	1	—	—	P. S. Barrett.
0.25	6.06	12.45	— 6.39	18.8	—	—	20	E	26	E	14	12	8	8	—	—	2	2	—	Samuel L. Brooks.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
.198	7.82	6.52	— 1.30	36.0	—	—	—	—	—	SW	14	—	—	—	—	—	2	—	25	W. H. Colwell.
0.52	6.69	5.84	— 0.84	31.5	—	—	—	—	—	W	20	14	9	5	4	—	—	2	—	Arthur Smith.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
.02	6.83	—	—	33.8	—	—	—	—	—	S & SW	14	23	1	4	—	—	—	—	25	Mrs. E. E. Bleakman
—	5.44	5.30	— 0.14	10.0	—	—	—	—	—	SW	10	11	9	8	—	—	—	—	—	P. Zohner.
.0.76	5.65	11.74	— 6.09	†	3941	5.9	30	SW	11	SW	14	10	15	3	—	—	—	—	—	William Bell.
0.03	7.39	14.50	— 7.11	†	2858	4.2	24	SE	19	SW	17	16	11	1	—	—	—	—	—	Charles Stewart.
—	8.49	—	—	30.5	—	—	—	—	—	SW	16	7	16	5	—	—	—	—	—	J. D. McNelly.
1.67	9.23	11.31	— 2.08	28.0	1434	2.2	—	—	—	—	8	13	10	5	—	—	—	—	—	J. K. Romig.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0.60	7.68	8.54	— 0.86	26.0	—	—	—	—	—	—	14	21	2	5	—	—	—	—	—	Wm. C. Cusick.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0.51	8.25	7.67	— 0.58	—	3685	5.5	28	SW	13	SE	16	18	5	5	—	—	—	—	—	C. H. Stuller.
—	4.58	—	—	29.0	—	—	—	—	—	—	10	14	10	4	—	—	—	—	—	T. L. Arnold.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	4.55	—	—	24.3	—	—	—	—	—	SW	10	12	7	9	—	—	—	—	—	J. H. Neal.
—	—	—	—	27.4	—	—	—	—	—	SW	10	19	3	6	—	—	—	—	—	F. W. Chrisman.
2.98	8.85	10.17	— 1.32	4.0	—	—	—	—	—	S	15	5	15	8	—	—	—	—	—	S. C. Beach.

## TABLE NC

PRECIPITATION TABLE: Total daily amount of precipitation, including rain, hail, sleet, and melted snow, in inches and hundredths. For the month of February, 1891.

DISTRICT AND STATION.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
COAST—																		
Fort Canby, Wash	.03			.10	.55	.27	.02		.65	.45	.39	.47	.38	.28	.51	.01	.61	.10
Astoria	.06			.03	1.01	.44	.06		.72	.38	.54	.83	.43	.58	.48	.01	.18	.53
Tillamook																		
Tillamook (L. H.)																		
Toledo																		
Gardiner				.37	.53	.97	.21		.30	.08	.95	1.70	2.31	.23		.13	.90	.11
Bandon	.19			.18	.34	1.12			.28	1.72	1.57	.50	.51	.18	.04		.86	.14
Gold Beach	1.64	.62	1.23	.96	1.05	.84	†							.79	.37		.36	
WILLAMETTE VALLEY—																		
Vancouver Barracks, Wash				.20	.21				.05	.18	.16	.42	.49	.10	.62	.21	.15	.40
Vernonia	.07			.02	.37	.63			.20	.14	.46	.94	.73	.59	.10		.24	.14
Deer Island				.15		.47	.11		.32		.43		1.22			.32	.21	.23
Portland	.04			†	.12	.37	.09		.06	.23	.37	.60	1.04	.56	.20		.11	.01
East Portland																		
Forest Grove				†	.20	.51	.08		.03	.04	.15	1.05	.50	.38	.10	.30		.02
McMinnville	.15			.06	.20	.57	.10	†	.06	.05	1.20	.85	.97	.27	†	.15	.18	.46
Hubbard	.16				.15	.35			.03	.25	.34	.68	1.05	.24			.13	.03
Mount Angel	.18			.01	.07	.36	.01			.30	.25	.56	.18	.15	.07	†	.05	.02
Eola				.22	.33	.23	.06		.22	.60	.58	1.34	.43	.06		.07		
Albany				†		.76	.08		.04	.30	.34	.83	1.72	.30			.18	.03
Corvallis				.80	.74	.55			.25	.50	1.60	1.10					.21	
Engene	.08			.05	.23	.23			.47	.11	.32	2.00	.63	.05		.15	†	.08
UMPQUA VALLEY—																		
Roseburg	.01	†			.05	.80	.14		.02	.37	.17	.16	2.90	.57		.04	.30	.35
ROGUE RIVER VALLEY—																		
Grant's Pass																		
Jacksonville				.02	.35	.27			.03	.25	.05	.25	1.47	.20			.06	
Ashland	.11					.47	.20			.39	†	.08	.37	1.14	.11		.03	
LAKE REGION—																		
Lakeview				†		.21			†	.11			.40	2.13	.70	.10		
Silver Lake																		
UPPER COLUMBIA RIVER BASIN AND EASTERN OREGON																		
Cascade Locks				.01	.49	1.60	.07		.42	.52	.44	.96	1.43	.31	.11			.11
Hood River					.30	.40			1.00	.20		.40	.85	.35				
Hood River, 5 miles south of					†	.14	.03				.06	.13	.43					
The Dalles	†																	
Dufur																		
Grass Valley																		
Prineville																		
Lone Rock	.10				.02	.24			†	.25	.03		.92			.15		
Heppner	.02				†	.03	.01			.03	.35	.12	†	1.23	.02	.02	.07	
Hardman				†	.02	.16			.47				.85		.10			.09
Ella																		
Alpine																		
Canyon City																		
Burns																		
Happy Valley				.16		.06				.15	†			1.00	.20	.16		
Pendleton	.16				.02				.05	.38	.01		.82			†		
Weston	.10																	
Walla Walla, Wash					.10	.04			.07	.37			.58	.27				
Spokane Falls, Wash	.04				.12	.07			.10	.13	.17		.54	.06	.05		.02	.05
Joseph	.05					.30	.10	.05		.05		.35		.82		.65		
La Grande				.19	.20	.10			1.30	.40			.60					
Telocaset					.10	†	.08		.20	.40	.10	.20	†	.35	†	.30		
North Powder																		
Baker City	.06				†	.40	.02		.02	.66	.06	.30	.03	.10	†	.14	.20	
Huntington																		
Beulah						.60				.34		.12		.22		.13		
Jordan Valley																		

ow, with total for month on right of total daily. The precipitation is recorded in inches  
indicates trace or sprinkle.

														Number of days on which rain, melted snow, sleet or hail fell, excluding fog, dew and frost.						Total No. of days.
9	20	21	22	23	24	25	26	27	28	29	30	31	Total for month.	Less than .01 of an inch.	.01 to .10	.11 to .25	.26 to .50	.51 to 1.00	Over one inch.	
.11 .51	.10 .50	.07 .22	.04 .11	.24 .13	.16 .05	.11 .12	.34 .09						5.99 8.01	0 0	8 6	4 5	7 5	4 6	0 1	23 23
.35 .04	.15 .31	.85 1.70	.52 .60	.53 .16	.43 .35 .37	.15 .12	.20 .86 .28	.15 1.02 .08	.95 1.16				12.88 14.06 8.64	0 0 1	1 2 1	7 7 0	4 5 4	8 4 4	2 6 3	22 24 13
.10 .23 .06 .23	.11 1.19 .46 .27	.02 .31 .22 .10	.21 .26 .45 .28	.05 .10 .33 .54		.02 .09 .10 .06	.59 .31 .05 .49	.08 .31 .08 .18					4.37 7.29 5.21 6.26 3.54 5.04	0 0 0 1	7 5 4 6	8 6 5 6	3 5 7 6	2 4 0 3	0 1 1 1	20 21 17 23
.22 .22 .38 .44 .98 .36 .80 .85	.04 .20 .32 .31 .25 .67 .30 .15	.13 .05 .35 .34 .18 .46 .25 1.05	.40 .15 .38 .37 .64 .57 .40 .78	.35 .12 .37 .51 .24 .14 .15 †	.20 .34 .04 .11 .03 .14 .17 .06		.28 .12 † .28 .20 .40 .52	.08 .29 .28 .07 .26 .20 .28	.47 .04 .10 .12 .07 .20 .26 1.78				11.50	1	6	4	5	3	4	23
24 08	.02	.56	1.05 .28	.31 .75	.05 .06	.01	.43	.23 .04	.27 .31				7.55 6.11 4.43	0 1	6 6	5 3	5 5	1 1	2 1	12 19 17
13	†	.21	.20				.15	.61	†				4.95	4	1	6	1	2	1	15
75 40 02	.38 .40 .07	.33 .80 .15	.10 .50 .68	.19 .40 .27	.07 .10 .08	.27 .15 .01	1.02 .25 .30	.04 .20 .12					9.69 6.70 2.47	0 0 2	5 1 6	3 4 4	7 8 3	3 3 1	3 0 0	21 16 16
11 15	.05 .12	† .09 .20	.24 .01 .15	.45 .17	.30	.08 .07 .20		.17 .06	.20 .02 1.00				3.01 2.90 3.38	2 2 1	5 13 4	7 4 4	1 2 1	1 0 1	0 1 1	16 22 12
03			.36	† .08	† .08	†	.34	.53 .10	.25 .10				2.70	3 2	2 6	6 1	0 2	2 1	0 0	13 12
01 02	.06 .03	.04 .05	.47 .12	.33 .05	.09 .15	.08 .05	.22 † .08	.07 † .18	.05 .15 .21				2.70 2.40 3.12 3.34 2.81	1 2 0 0 5	8 11 8 2 6	1 3 4 2 4	4 2 2 2 1	1 1 2 1 0	0 0 0 1 0	15 19 16 8 19
	†	†	.30	.08	.02	†	†	.02	.18				2.59	7	9	4	3	1	0	24
			.34	.60	.27			.11	.36				3.09	0	0	4	4	2	0	10





## NATIONAL WEATHER-CROP BULLETIN.

The following bulletin was issued by General A. W. Greely, chief signal officer, Washington, D. C., for the month of February, 1891 :

## TEMPERATURE.

The month of February was warmer than usual in the Southern, middle Atlantic, and New England States and from the Ohio valley northward over the lower lake region and lower Michigan ; the greatest excess of temperature occurring in the south Atlantic States, where the mean temperature of the month ranged from 5° to 10° above the normal. In the middle Atlantic States and lower lake region the excess amounted to about 6°.

The month was colder than usual generally over the western half of the country, including the upper Mississippi valley, over which the monthly deficiency was very slight, while it was unusually cold in the upper Missouri valley, where the deficiency in monthly mean temperature ranged from 6° to 16°. In the central Rocky Mountain regions and thence westward to the Pacific coast the mean temperature for the month was slightly below the normal.

## PRECIPITATION.

During the month of February there has been an excess of precipitation generally throughout the Northern States, over the northern portion of the East Gulf and South Atlantic States, in the region west of the Rocky Mountains, except in Washington and Northern Oregon, and on the West Gulf coast. The excess was most marked on the Pacific coast south of Washington, where the total precipitation for the month was double the usual amount. These timely rains terminated the drought period which had existed during the previous winter months. Large excesses of rainfall also occurred from Georgia northward over the upper Ohio valley.

The dry January over the spring wheat region, including Minnesota, South Dakota, and east portion of North Dakota, was followed by a slight excess of rain and snowfall during February, while in Eastern Iowa and Northern Illinois the rainfall for February was slightly less than the usual amount. Very little rain occurred from Southern Missouri and Kansas southward over Texas and in Florida and Southeastern Georgia.

Snow covered the ground at the close of the month generally throughout the lake region, Northern New England, and Northern New York, and at stations in the Northwest north of the fortieth parallel, the snowfall being light except that about one foot was reported on the ground in Northern New England, from ten to twenty-eight inches near Lake Superior, and from eighteen to twenty inches in Western Montana.

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GENERAL REMARKS.

The weather for the month was generally mild throughout the winter wheat region, attended by excessive precipitation. The month closed with a decided cold wave preceded by general rains throughout the entire wheat region, but owing to the backward condition of the crop it is probable that no serious injury will result from this sudden freeze. There is an excess of moisture throughout the greater portion of the wheat region, and the month of March opens with general snows throughout the Northwest and conditions favorable for rain covering the central valleys.

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## PACIFIC COAST WEATHER BULLETIN.

The following bulletin was issued by Lieut. John P. Finley, San Francisco, Cal., concerning the weather on the Pacific coast during February, 1891:

The month of February has been distinguished by the following important features: First—The southerly movement of three cyclonic areas which passed eastward through Central Oregon, giving rise to the heavy rains, high winds and high temperatures of the month in California and Nevada. Second—The violent cyclone of February 20 to 24, which gave rise to remarkably high and destructive winds, heavy rains and the lowest barometer readings for many years. Baker City, 28.94 inches; San Francisco, 29.10; Red Bluff, 29.02; Fresno, 29.32; Fort Canby, 29.06. Third—Seven cyclonic areas came within the limits of the signal service charts during the month, four of which passed eastward north of Washington. Fourth—The anti-cyclone of the 1st to 4th, which gave rise to a severe cold wave in Washington and Oregon, producing the lowest temperatures of the month. Baker City, Or., 12° below zero. This cold wave extended southward into Nevada and Eastern California on the 4th. Halleck, Nev., 14° below zero. Fifth—The anti-cyclone of the 7th to 9th, which gave rise to the severe "norther" of the 8th in California. This anti-cyclone was attended by the lowest temperatures of the month in California and Nevada and destructive winds in California, especially in the southern portion. Halleck, Nev., 23° below zero on the 9th. Heavy sand storms and killing frosts, with the blowing down of some buildings, attended the "norther" in Southern California. Sixth—The high southerly winds, high temperatures and heavy rains of the 12th to 17th, 20th to 24th, and 26th to 28th, in Northern California and Nevada. Seventh—From the 9th to the last day of the month the presence of a cyclonic disturbance was manifest without cessation off Vancouver's Island.



## RAINFALL.

The rainfall has been in excess of the normal in all districts except Western Washington and Northwestern Oregon. The long spell of drought was broken on the 14th, and in the last half of the month enough rain has fallen to carry the amount decidedly beyond the normal in Southern Oregon, California and Arizona. If this large precipitation could have been distributed over the month much less damage would have resulted to property and greater benefits derived from the greatly needed moisture. The excess varies from 0.19 inches at Winnemuccato, 4.84 inches at Los Angeles, 6.83 at Red Bluff and 6.78 at Roseburg. The deficiency ranges from 0.19 inches at Fort Canby to 3.55 inches at Olympia. The rainfall at San Francisco has been exceeded in six other years during the past forty years; the largest amount, 12.52 inches, occurred in February, 1878, and the next largest amount, 9.24 inches, in 1887. The largest monthly rainfall was 11.50 inches at Roseburg. The greatest in 24 hours was 3.80 inches at Red Bluff on the 14th. Rain fell on 23 days in Washington, on 26 days in Oregon, on 25 days in California, on 22 days in Nevada and on 10 days in Arizona.

## LOCAL STORMS.

Thunder storms—Eureka, 17th; Gilroy, 24th; Vacaville, 25th. Buildings struck by lightning—Shasta county, 18th. Hail—Eureka, 17th; San Francisco, 24th; Astoria, 6th, 19th; Shasta county, 18th. Winds of over 30 miles per hour occurred on 2 days at Eureka, 5 days at Fort Canby, 6 days at San Francisco, Red Bluff and Sacramento, and 14 days at Winnemucca.

## TEMPERATURE.

It has been almost stationary in all districts with a slight excess of 1° to 2° in Northern Nevada, Western Arizona and Southwestern California. The deficiency ranges from 4° at Keeler to 3° at Red Bluff and Olympia and 1° at Eureka, Fort Canby and Spokane Falls. The highest temperature, 74°, occurred at Yuma on the 7th and 14th. The lowest, 23° below zero, occurred at Halleck, Nev., on the 9th; Baker City, 12° below on the 2d.

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INFLUENCE OF JAPAN CURRENT UPON THE CLIMATE OF OREGON AND WASHINGTON.

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The geographical position of these two States is a most fortunate one. Located in the latitude of the easterly trend of the central portion of the Japan current they receive the full benefit of the warmth and moisture continually rising from this great stream. The atmospheric eddies or areas of low barometric pressure forming over the Japan current enter the continent throughout

the year in a manner to provide a most equable distribution of rain. The relation of the two great States to the Japan current is one of vital importance to their commercial and agricultural interests, and should be clearly understood by the people. Reverse the direction of this current so that its motion in the equatorial regions is westerly and in the temperate zone easterly, and shift its latitude a few degrees to the south, and the North Pacific coast States would become barren and bleak as Northern Canada and Labrador. How great a factor then in the development of a country is the supply of heat and moisture.

The following is a brief summary of the effects of these features of the Japan current :

1. A general equability of temperature unequaled in any other portion of the United States.
2. A gradual change from the heavier rains of winter to the lighter rains of summer, giving rise to the most beneficial distribution of precipitation throughout the year.
3. In the winter the atmospheric disturbances from the Japan current move eastward at a lower latitude than in summer, and this shifting north and south of the storm centers makes the difference in rainfall between the two seasons. But as the change of the centers is not very great respecting Oregon and Washington these States are always within the area of precipitation accompanying the low pressure area.
4. A prolific growth of all forms of plant life.
5. Climatic conditions which favor to a marked extent the growth of most cereals and other staple crops.
6. The alternation of rain and fair weather in such a manner as to provide suitable conditions for planting and harvesting.
7. The absence of excessively violent storms, owing to the southwest deflection of the Japan current at the parallel of 45° north; the cold Alaskan current along the California coast; and the dry atmosphere of the middle plateau region.
8. Computed from the records of nearly twenty stations covering a long series of years the percentage of rainfall in Washington varies from 2.05 per cent in August to 15.70 per cent in January.
9. Computed from the records of stations covering a long series of years the percentage of rainfall in Oregon varies from 1.25 per cent in August to 17.10 per cent in December.

## THE WEATHER SERVICE.

AN ADDRESS BEFORE THE MISSOURI AGRICULTURAL INSTITUTE BY PROF.  
F. E. NIPHER, OF ST. LOUIS.

The first proposition to distribute weather warnings by telegraph for the benefit of commerce and agriculture was made by Lieut. Maury, a man whose

name was a household word before the war, and whose scientific services to the country have never been excelled.

The plan was carried out on a large scale soon after the war by the signal corps of the army, which was reorganized by General Meyer for that service.

In comparing our weather service with those of countries like England, Germany, Norway, Sweden, it should be remembered that they have areas comparable with those of States like Missouri. For the prediction of large storms, like those which characterize our winter months, the vast extent of our national area is of great advantage. But many storms are local in their character, and to study and predict such storms over so vast an area, from a single office is a very difficult task indeed. It has never been satisfactorily done. Moreover the study of the climate of States can be best done by the States themselves. Recognizing these difficulties of the national service, Dr. Hinrichs, then a citizen of Iowa, organized the Iowa weather service, about fifteen years ago, and shortly after the Missouri weather service was organized by myself.

For a number of years these two State services were the only ones in existence in the country.

The Missouri weather service I have continued up to the present time, and it is now being conducted wholly on private means.

In the meantime such services have been started in many other States, and their number is increasing in a very gratifying way. Many of the States have made liberal appropriations for them, and there is little doubt that finally each State will be furnished with a well-supported weather service. There are always many intelligent persons in each State who take an interest in weather observations, and who take an honest pride in coöperating with a public service. The people of the country are not yet all wholly devoted to money-getting. I have found them in many cases willing to expend considerable amounts for instruments. The daily work of the observer requires only a few minutes, but it is a constant care. If he is absent for a day, it is necessary for him to provide for the making of the observations in his absence. When men of this kind can be found who are willing to render a valuable service to the State free of charge, they ought to be encouraged. That kind of statesmen are not by any means too numerous.

The State weather service should aim to study the climatic peculiarities of the State, with particular reference to the crops which are grown. What are the conditions of weather which cause insect pests to thrive? How frequently do the weather conditions cause ruinous damage? Does it therefore pay to raise certain crops, or may we more profitably give our attention to some other crops more suited to our conditions? These are questions which should be examined by an appeal to weather records, and crop and market reports.

Bridge and railway engineers are interested in knowing how frequently

rains of three, four, five or six inches may fall in a single hour. How frequently does it rain for two hours at the rate of two inches an hour? Until such questions can be answered with reasonable precision, the dimensions most suitable for culverts and waterways for railroad and highway bridges can only be rudely estimated.

If the water supply of a city is partly or wholly derived from rainfall, it is most important to have authoritative records of severe drouths. In no other way can the proper storage capacity of the reservoir be determined. Such records of the climate of different States should be furnished to the national service, which should combine the work of all the States, and make up the rain and temperature charts for the entire country.

The work of weather prediction has thus far been carried on only by the national service. At first the country was divided into divisions comprising several States, as the upper Mississippi valley, the lower Ohio valley, etc. There has however been a popular demand for predictions of a more local character, and the national service has attempted to meet this demand. The predictions are now made for each State. Evidently, however, the difficulty of making weather predictions from a single office increases very rapidly as the predictions become more local in their character, and for two reasons. In the first place, the time that can be given to the predictions by a single officer, is only about one minute for each State. He glances over the network of pressure and temperature lines, he notes the regions where rain may have fallen, he sees how the conditions have been changing since the last map was made, and by a sort of intuition, and perhaps without being always able to give definite reasons for his conclusion, he makes up our weather to the best of his knowledge and belief. The more local his predictions are, the less will be his time for considering the conditions in any one locality. Further the phenomena increase amazingly in complexity as we come to consider minute details.

We all have a fair idea of the general topography of our country, so long as we confine our attention to its grand outlines. Rising from the eastern ocean, the surface culminates in a mountain range stretching from near the Gulf of Mexico to New England. To the west we have a descending slope to the Mississippi river, then comes another rising slope, the great plains, the western mountain ranges and descent to the sea. Suppose now we come to consider the matter more minutely. We shall soon be lost in a mass of details, which it is absolutely impossible for any one man to picture in his mind, as we can all picture the grand features of topography. Nevertheless the hills on our farms are important matters to us, and they concern us more directly and constantly than does the Mississippi valley or the Alleghany mountains.

In a similar way must it remain forever impossible for any one man to give us the information we should have in regard to the weather. He can form a general idea of the movement of the larger storms, and cold waves, which are



common in winter, and such information is of vast importance to many people. The movement of thousands of tons of meats, fruits and vegetables is controlled wholly by the weather reports. On the approach of warmer weather meats are hurried into cold storage warehouses, and the opportunity to ship other provisions which must be kept from freezing is anticipated and made available.

But the storms which are of the greatest interest to the farmer are the local rains of summer. They surprise him with hay down, and they destroy or damage his crop. They are very local in their character, often expending themselves over a few counties. Sometimes these rain storms travel over a belt of country twenty-five to fifty miles in breadth, and extend across a State. You see a heavy bank of clouds edging up against a brisk wind. As it approaches you see that its front is margined below with long streamers, and above is tumbled into rounded heaps by the winds. The deep rumble of thunder increases to a roar. Suddenly the wind which had been blowing towards the storm ceases, as you pass through a belt of upward currents which margin the cloud front, and then with a mighty rush of roaring wind and beating rain the storm is upon us. The wind gradually lessens, the cloud shows a smooth leaden hue, the rain sets in steadily for an hour or more, during which the wind backs around into its original direction. The cloud finally begins to disperse and the storm is over. Not a season passes that single storms of this kind do not inflict enough of preventable damage to pay the annual expense of a State weather service. But it is impossible for the Washington office to predict storms of this kind for the whole country. It is absolutely out of the question. No one man can mentally picture the meteorology of the whole country down to such minute details. Such work must be done by a local weather service, and it can be so done. The national weather service now issues predictions which read "local rains in Missouri." Now it is not of great importance to a farmer in Saline county who has cured hay spread over his field as the mower left it, that merchants and other people in Sedalia or Hannibal or St. Louis should read in their morning papers that there will be local rains in Missouri. The farmer is not in communication with these people or with the Washington office, and hence cannot share the joy of this discovery. And furthermore, such predictions would be of very little value to any farmer, even if they could be placed upon his breakfast table each morning. Such rains may occur here and there in a few counties, but there is little gain in setting all the people of the State into motion, in preparing for a rain which will affect perhaps only a small portion of them. The result is that people who can get such weather predictions, pay little attention to them, because they have learned by experience that this simply means it may rain in our particular locality and it may not, a thing which they know without the aid of any weather predictions. But such predictions from the national weather service, with data giving the general conditions of the weather, would be of great value

to a local weather service, and I wish to give a brief sketch of how they may and will be utilized in the near future.

It will be but a short time when the broad patents on the telephone will expire. This will have little effect on the large telephone systems of great cities, but it will undoubtedly compel a decrease in telephone rates in smaller cities so that farmers can afford to use them. In such places it will be possible for competing systems to start for the use of farmers, and the tradesmen will go with the farmers.

I do not anticipate such competition, as telephone people are usually good business men, and they will hold their ground by reducing their rates to fifteen or twenty dollars a year for farmers. Under such conditions any farmer could afford to place a telephone in his house. The value to him is evident enough. He can keep continually informed of the markets. He will never stand on the streets with a load of hay waiting for a customer, and wishing that his hay was at home again. He will know before he starts from home who will buy his produce, and what he will get for it, and he will keep it in his barn until he gets his price. During the busy time of harvest, if his reaper breaks down, he can learn whether the new casting which he needs can be secured in town, and if not, he can order it. The grocer and butcher will fill his orders, and delivery men who make this their business will each morning make up a route to deliver his goods, bring his mail, and perform any other service which he may desire. In addition to this, he can at any time get the weather reports. The local weather service can, during the harvest season, receive information of the appearance of any storm, and can telephone the proper warning to county seats where such information should be sent. The telephone companies will receive and transmit such warnings to subscribers in order to increase the value of their service, and induce people to use their telephones. A warning of rain can be rung on all the call bells by a code of signals. Many of the subscribers will be prepared for a rain, and to them the warning will be sufficient. If a farmer wishes to know more about the situation, in order to be better able to decide his plans, he may easily call up the central office at his county seat, and learn that it is now raining in all the counties to the west, and apparently a general rain is coming in about two hours.

No thoughtful man can fail to be impressed with the profound influence which the telephone is destined to exert upon the condition of the farmer. It is perfectly apparent that all of the benefits and advantages here described, with many others, are entirely within his reach, as soon as the telephone ceases to be a monopoly. That the service can then be rendered at a price such that no enterprising farmer can afford to be without his telephone, is equally certain.

The inauguration of such a system of harvest rain warnings will necessarily be done gradually. It can best be done by a weather service supported by the



State. Some one must take hold of the matter and show that it can be done. At present such a weather service should secure correspondents in each county, who should be provided with blanks for recording the time of beginning and ending of each storm, the direction or motion of the clond, the amount of rain, and such other features as may be observed. Such reports would in a few years give a good knowledge of the behavior of summer rain storms. By that time it will be possible to inaugurate the plan which I have roughly outlined.

This is not the first time I have been here to advocate this cause. In 1883 and again during the last legislative session I made a similar presentation of this plan. It has been my dream for thirteen years and I have expended many hard earned dollars in trying to bring the plan to completion. It may be that the State board of agriculture can succeed in securing the inauguration of a measure which I, as a humble citizen, have thus far failed to bring about as I had wished. I am here, gentleman of the legislature, to urge upon you to entrust this work to their hands. I gladly step aside and transfer to them the interest which has been mine, and trust that they will secure the coöperation of the public and the support of the State. It is not a small or unimportant matter which we are considering, and it is not an untried scheme. It is simply supplemental to the work now being done by the national service. The work laid out for the State service is work which the national service has not done and cannot do, but it is a work in which the national service can greatly aid by coöperation with States which show a disposition to help themselves.





